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SOVIET METHOD FOR DELIVERY AND COLLECTION OF FREIGHT CARS

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Significance

Use of the Mamedov method concerns all those who are responsible for handling spur track traffic.

This method helps reduce the layover time of cars, particularly in large freight stations that have a number of spur tracks to be serviced, and tends to speed up the handling of spur-track traffic. Calling for close planning and organization, use of the method helps to reduce car turnaround time.

In a large freight station, much of the layover time is spent at locations on spur tracks or in awaiting movement to or from such locations. Much depends on the order in which cars are delivered to or collected from spur-track locations. This is largely ignored, resulting in much unnecessary waste of time by cars awaiting movement. That this time constitutes a substantial proportion of the layover time can be seen from the following breakdown of the layover time of a certain station (in percent):

Entry-into-station procedures, 7.4

Breakup of train, 2.8

Awaiting delivery, and delivery, 16.0

Unloading and loading, 10.6

Awaiting collection, and collection, 12.2

Classification of cars, 37.6

Marshaling of train, 5.2

Departure procedures, 8.2.

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The greatest amount of time (37.6 percent) is spent in classification of the cars. This time is influenced by the direction or destination of the cars and by the number that are to be dispatched in each direction in each 24-hour period. The next-longest times are those spent in awaiting delivery or delivery (16.0 percent) and in awaiting collection or in collection (12.2 percent). These two items total 28.2 percent. The time spent in the actual movement of delivering or collecting cars is very shsort, and by far most time is consumed in waiting. That is, after a train is broken up, the time spent waiting for delivery and waiting for collection is nearly one fourth of the total layover time. This time is not productive but idle time. While it cannot be avoided entirely, it should and can be considerably reduced.

How is this reduction to be effected? With scores or hundreds of cars arriving and departing daily, should those be delivered first whose place of unloading is nearest or most distant? Should those cuts be delivered first which contain the largest or the smaller number of cars? Similar questions arise with regard to collections. What principle should govern? Mamedov, the stationmaster at Khvoynaya, in the Moscow Railroad Bureau, developed a procedure to help answer these questions. This method has been tried on the Chinese Ch'ang-ch'un Railway with good results.

Criteria for Priority in Delivery and Collection

In this method, Mamedov deals first with delivery. Before starting to deliver any cars, find out how long it takes to make a delivery to each location on each spur track and divide these by the number of cars to be delivered to each location. This will give the distributed average time for each car. Then deliver first those cars that require the shortest time for delivery, then those requiring longer time, and last those requiring the longest time. This method minimizes waiting time. It uses arithmetic scientifically, taking several factors into account, and does not rely merely on convenience, distance, or number of cars alone. The order of collection of cars from spur-track locations should be determined in a similar manner.

Efficient shunting operations depend on teamwork by the men on duty. The yardmaster must know the car situation in the yards at all times, and in accordance with the method indicated above, he should make the necessary computations and determine the order of operations. With each worker doing that for which he is responsible, a smoothly working system will gradually develop. Such a system makes possible clear "marching orders" which unify and secure concentrated cooperative efforts that result in effectively reducing car layover time.

Illustrations

Suppose a station has five spur tracks, as shown in the sketch below; and that the respective distances from the station to the points of loading (or unloading), the respective standard times allowed for one such trip, and the number of cars to be delivered to each track are as shown in the first four columns of Table 1. The figures in column 5 are found by dividing the figures in column 3 by those in column 4. The figures in column 6 indicate the order in which the several tracks should be serviced, in the light of the figures in column 5. Columns 7 and 8 are a rearrangement of column 6 in conventional order.

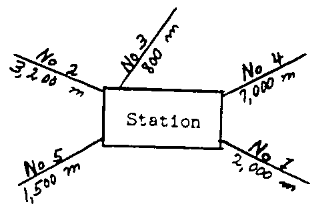

Table 1. Order of Shunting Service

Spur Track No	Length of Spur Tracks (m)	Standard Time for One Round Trip (min)	No of Cars	Distributed Time per Car (min)	Priority of Service	Order of Service	Spur Track No
1	2,000	20	10	2	1st	1st	1
2	3,200	30	3	10	5th	2d	4
3	800	8	1	8	4th	3d	5
4	7,000	70	20	3.5	2d	4th	3
5	1,500	16	3	5.3	3d	5th	2

The standard time for one round trip means, in the case of delivery, the average time required to make one delivery of one or more loaded (or empty) cars to a point on a spur track and for the shunting engine to return to the yards, as previously ascertained and sanctioned. In the case of collection, it means the average round-trip time required to make one trip to collect one or more cars from a point on a spur track and return to the yards.

As indicated in Table 1, it may be concluded that it is best first to deliver the ten cars to spur track No 1, because the distribution time per car, 2 minutes, is lowest of all; second, to deliver the 20 cars to track 4; third, deliver the three cars to track 5; fourth, deliver the one car to track 3; and, lastly, the three cars to track 2.

Ordinarily, the order of delivery would not be determined in this way. But the order of delivery would probably be influenced by the arrangement of the tracks, or the number and distribution of the cars; and, without regard to how long the different cuts of cars might have to wait for movement, delivery would be made in whatever manner seemed most convenient at the time when the shunting crew was ready to handle the task. The order might be as follows: tracks, No 5, 2, 3, 4, 1. At any rate, assume this order for the purpose of illustration. We will now proceed, compare the new and old methods from the standpoint of time sp... by cars waiting to be shunted on to spur tracks.

1. According to the old method, each car would spend, on the average, 65.2 minutes in waiting for delivery. This figure is computed as indicated in Table 2.

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Table 2. Average Time Spent Waiting for Delivery, by Old Method

A	B	C	D	Time Spent Waiting for Delivery (min)		
Order of Delivery	No of Track	No of Cars	Time Allowed	Per Car	Per Cut	Subtotal
1	5	3	16	None	None	None
2	2	3	30	16	3 x 16	48
3	3	1	8	16+30	1 x (46)	46
4	4	20	70	16+30 8	20 x (54)	1,080
5	1	10	20	16+30+8+70	10 x (124)	1,240
Total		37				2,414

The average time per car spent in waiting is 2,414, divided by 37, equals 65.2 minutes.

Column headings: A, the order in which the delivery trips are made.

B, the ordinal number of the spur tracks.

C, the number of cars in each cut.

D, the standard time allowance for one delivery round trip.

Note: No time is spent waiting by the first cut of cars. The second cut must wait until after the first cut has been made; and similarly for the other cuts.

2. According to Mamedov's method, each car would spend an average of 30.2 minutes waiting for its delivery. This figure is computed as indicated in Table 3.

Table 3. Average Time Spent Waiting for Delivery, by New Method

A	B	C	D	Time Spent Awaiting Delivery (min)		
Order of Delivery	No of Track	No of Cars	Time Allowed (min)	Per Car	Per Cut	Subtotal
1	1	10	20	None	None	None
2	4	20	70	20	20 x 20	400
3	5	3	16	20 + 70	3 x (90)	270
4	3	1	8	20 + 70 + 16	1 x (106)	106
5	2	3	30	20 + 70 + 16 + 8	3 x (114)	342
Total		37				1,118

The Average time per car spent in waiting is 1,118, divided by 37, equals 30.2 minutes.

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The above calculations clearly show the advantages of the new method; for each car, on the average, saves 35.2 minutes [sic; should be 35.0] of waiting time. This is equivalent to 0.587 car-hour. If a busy freight station handled the delivery of 100 cars in each 24-hour period, [and the same number of collections, with corresponding savings], and the Mamedov method were faithfully followed, 117.4 car-hours could be saved. This is equivalent to adding 4.89 cars in operation [per day].

If this method were faithfully followed in all the large freight centers of China, it would be equivalent to gaining more than 50 cars in operation. This would have a considerable effect on transportation efficiency and traffic capacity, possibly affecting both economic and military situations of the country. Since the same method is applicable for calculating savings in making collections, it is unnecessary to make the computations here.

The illustrations presented above indicate how to ascertain the order in which deliveries (or collections) should be made. Now let us take another illustration to show how the calculations as to order of service are made in cases where both deliveries and collections are made on the same shunting trip. In such cases, the standard time allowed for one spur-track round trip must be increased by the working time of the shunting engine at the customer's platform. Then, divide this time by the number of cars to be delivered and collected at that platform; this will give the average time per car for delivery or collection. When this is computed for each track and the figures are compared, the best order of service will be clearly indicated.

To illustrate, suppose a certain station has three spur tracks to be served, with their respective distances and standard time allowed for a trip given as follows:

Spur tracks No 1 -- distance, 2,000 meters, and time allowance, 20 minutes; No 2 -- distance, 1,000 meters, and time allowance, 10 minutes; No 3 -- distance, 3,500 meters, and time allowance, 35 minutes.

In addition to the standard time allowance for one trip delivery, or collection, in cases where both services are to be performed, 5 minutes is the standard working time allowed for each time that the shunting engine has to couple onto a cut of cars. Now, assume there are 16 cars to be delivered and 12 cars to be collected, distributed as follows: track No 1, deliver 5, collect none; track No 2, deliver one, collect 2; track No 3, deliver 10, collect 10. Also assume that on tracks No 2 and 3, the shunting engine is to couple onto one cut in each case. The calculations, according to the Mamedov method, will be as shown in Table 4.

Table 4. Determination of Order of Service When Both Deliveries and Collections Are To Be Made

Track No	No of Cars to Be Handled			Time Needed for Delivery and Collection (min)			Avg Time per Car	Order in Which to Make Delivery
	Del	Coll	Total	Standard Time for Trip	Added Working Time	Total		
1	5	--	5	20	--	20	4	2d
2	1	2	3	10	5	15	5	3d
3	10	10	20	35	5	40	2	1st

Table 4 shows that it is most advantageous to first serve the 20 cars on track No 3, then the 5 cars on track No 1, and lastly the 3 cars on track No 2. Let us assume that, according to the old method, service would be in the order of tracks No 1, 2, and 3. Using the method of calculation indicated in Table 4, the average time used per car is 27.1 minutes. If the order of service is as indicated by the calculations of the Mamedov method, the average time used per car is 13.6 minutes. Comparing these two, it will be seen that the new method makes possible an average saving of 13.5 minutes per car.

The Mamedov method thus makes it possible to save much waiting time. In this connection, it should be remembered that this does not involve any more work on the part of the shunting engine, and yet the application of the method is simple and easy. Provided that the car situation at a given time is known, the proper figures quickly can be filled in on the form of Table 4, and the most advantageous order of service can be determined in a few minutes. In practice, it is unnecessary for a station to bother with any tables other than Table 4; other tables are given here solely for the purpose of comparing the results of the old and new methods.

Points To Be Noted

For the use of the Mamedov method to be fruitful, it is essential for all participants to have a clear perception of the importance to the railways and to the country of avoiding every minute of waste time for every car and locomotive. Although this method deals directly with only one element in layover time, its use in the Harbin railway station for 3 months has produced very good results. The statistics for this period show an average of waiting for delivery of 1.34 hours per car, per trip, and of waiting for collection of 1.1 hours per car, per trip. These two components combined correspond to a saving of 38.5 percent. As a result of use of this method in the Mukden station, the average total layover time per car has been reduced by 11.7 percent. The possibility of reducing layover time, and thus of turnaround time, through careful attention to the small items related to avoiding time wasted in waiting for delivery and collection has stimulated the workers to extend the application of similar attention to other elements of layover time and other components of turnaround time. In this way, the use of the new method has been both directly and indirectly beneficial.

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